

Economic and Social Consequences of Overweight and Obesity in the Education Sector in Sinaloa, Mexico

Dr. Rigoberto Ocampo Alcántar

Professor and Researcher at the Faculty of Social Sciences
Universidad Autonoma de Sinaloa
Mazatlan, Sinaloa, Mexico

Abstract

According to the World Health Organization overweight and obesity are risk factors for diabetes and cardiovascular disease. This non-transmissible health problem is the leading cause of death in the world since 2012. Even though it is a preventable problem, it has now reached children. The overweight and obese children are likely to develop diseases early in life such as diabetes and cardiovascular disease. This paper describes and analyzes the Mexican education sector's strategies implemented to cater to this segment of the population at risk, as well as the consequences for social and economic development.

Keywords: Overweight, Obesity, Children, Temperature, Budget

Introduction

Overweight and obesity are considered risk factors for diseases such as diabetes, osteoarthritis and cardiovascular disease (which have been the main causes of death in Mexico since 2008). Childhood obesity in particular is associated with obesity, premature death and disability in adulthood, as well as leading to respiratory difficulties, increased risk of fractures, hypertension, early markers of cardiovascular disease, insulin resistance and psychological effects. (World Health Organization, 2015). This condition usually begins in childhood or adolescence and arises from the imbalance between food intake and energy expenditure; is a chronic, complex and multifactorial disease. According to the World Health Organization (WHO) in 2008 35% of adults aged 20 or more were overweight, and 11% were obese. This health problem, which is non-transmissible and preventable, has reached the world's children and has become a critical theme in public health due to its rapid growth in recent years. In 2013 there were more than 42 million children under the age of five who were overweight or obese around the world, 35 million of whom live in developing countries. (World Health Organization, 2015). In schools, this health problem in some cases is manifested in low academic achievement, as well as a cause for the emergence of other needs such as trained teachers and personnel dedicated to serve at-risk populations, as well as the implementation of prevention strategies. Even facilities should be adapted, providing equipment and furniture to create a pleasant and quality atmosphere in order to guarantee the physical and mental health of overweight and obese school children. In some school campuses of the State of Sinaloa electric power substations were installed for the proper functioning of air conditioners in classrooms, in order to counteract the effect of climate on students, especially those overweight and obese, which are prone to hyperthermia, heatstroke or sunstroke.

Within the Action Plan of the School and Health Program (*Programa Escuela y Salud*) which began during the 2011-2012 school year, the Ministry of Education and Culture of Sinaloa (SEPyC) conducted the State Register of School Health (RESE, for its initials in Spanish). The aim of this mechanism is to know the conditions of the population enrolled in the Elementary level of public and private schools, in order together information for planning and implementing strategies to prevent and counteract overweight and obese children in the state. However, state programs on prevention and control of overweight and obesity generate significant cost for Mexico: "The economic effects of obesity have been estimated by researchers from the economic analysis unit (UAE for its Spanish acronym) of the health area. They analyzed the cost on two of their external negatives: The direct annual cost on medical attention for the public system of health of 14 complications from 4 groups of diseases related to obesity diabetes mellitus type 2, cardiovascular diseases.

Breast cancer and osteoarthritis, that for 2008, got estimated in 42 000 million pesos under a scenario base of 13% of the total expenses in health for that year. The external financial measure through the non-direct cost of productivity loss is estimated for 2008 in 25 000 millions of pesos. The total sum estimated for direct and non-direct expenses for 2008 was of 67 000 million pesos. In 2017 is estimated that the direct cost could go between 78 000 to 101 000 million pesos from 2008 and the indirect cost could go between 73 000 and 101 000 million pesos from 2017, that is if the measures taken by the government didn't make a significant impact." (Dommarco Rivera, 2012, p.7). The increase in overweight and obese children that attend school sites requires qualified personal attention, as well as adapting existing facilities of schools across the state: multiple use spaces and accessibility, furniture and equipment. One of the most recent requirements that the education sector in Sinaloa has added to its budget are electric substations, in order to supply the necessary energy for the proper functioning of air conditioners. To this we must add the increase in monthly electricity consumption. These two factors have significantly increased public expenditure in this sector. The increase in infant school population with overweight and obesity has significantly increased the education budget in order to meet the requirements of electrical substations at school sites and the monthly billing of electricity consumption. Overweight and childhood obesity have consequences not only on the individuals who suffer these conditions and their families, but also impact the public sphere. Schools across Sinaloa have seen an increase in the requirements of public schools' power substations, in order to have sufficient energy supply for the operation of air conditioners. This requirement is directly related to the increase of children with overweight and obesity. In this regard, electrical installations become necessary in order to meet the commitment to provide the student community (overweight and obese) a convenient school ("Escuela Digna"). This has caused a budget impact on the public education sector.

1. Overweight and Obesity

This condition is diagnosed when an individual has abnormal or excessive fat accumulation. It can affect both men and women of any race, nationality and socio-economic strata. The Body Mass Index (BMI) is an indicator used to measure overweight and obesity. It is calculated by dividing a person's weight in kilos by the square of their height in meters (kg / m^2). Overweight is defined by a $\text{BMI} \geq 25$ and obesity at a $\text{BMI} \geq 30$. WHO statistics indicate that in 2013, one billion adults were diagnosed overweight: if the trend stays uninterrupted, they will exceed 1.5 billion in 2015; it also reported that more than 300 million individuals were obese. Every year approximately 2.6 million people die from diseases associated with obesity or overweight, including diabetes, cardiovascular disease and cancer. In Mexico, according to the National Health and Nutrition Survey 2012 (ENSANUT) 73% of women and 69.4% of men are overweight and obese. And when it comes to schools, more than 4.1 million children hold one of these two conditions (National Institute of Public Health, 2012). On the other hand, during the Fourth Symposium on Global Health Issues with Local Impact, the National Public Health Institute (INSP) showcased the expected trend of overweight and obesity from 2010 to 2050. If the trend is not reversed, in the case of the percentage provided for women is 81% in 2030 and 88% in 2050. In men will rise from 85% in 2030 to 91% in 2050 (National Institute of Public Health, 2014). Other information issued by the INSP is the projection of deaths due to diseases such as diabetes mellitus and cardiovascular disease from 2008 to 2017 (go from 45,000 to 68,000 deaths annually. (National Institute of Public Health, 2014).

2. Overweight and Childhood Obesity

For two decades, scientists have noticed an increase in overweight and obese individuals and how this problem has now reached school age children; this situation has alerted the world. In 1990 there were only 31 million (5%) of children under 5 who were overweight and obese, and in 2012 about 44 million (6.7%) of children under 5 suffered from one of those two problems. These conditions are associated with a wide range of serious complications and an increased risk of premature diseases like hypertension, insulin resistance, poor blood glucose tolerance, hyperlipidemia, orthopedic problems, polycystic ovary, skin diseases, among many others. This causes decreased life expectancy and quality of it (World Health Organization, 2014).

3. Overweight and Childhood Obesity in Mexico

The National Health and Nutrition Survey 2012 (ENSANUT) in Mexico states that 35% of adolescents between 12 and 19 years are overweight or obese. That is, more than one in three Mexican adolescents have one of these two conditions. With regard to school-aged children ages 5 to 11 of both genders, the survey showed a combined national prevalence of overweight and obesity of 34.4% (19.8% for overweight and 14.6% for obesity). That is, one in five adolescents are overweight and fifteen in every hundred is obese.

In the state of Sinaloa, the percentage of children under 5 who are overweight and obese was 9.6%. In school-children of 5 to 11 years it was 17% of overweight children and 14.7% of obese children, making a sum of overweight and obesity of 31.6%. As for gender distribution: in 2012 a higher percentage of men (33.9%), compared with 25.6% of women was reported. For teenagers of Sinaloa who live in urban areas, the number of overweight or obese remained at 30.9% in 2006 and 2012. And for people in rural areas this figure is currently 27.3%. (National Health and Nutrition Survey ENSANUT, 2012. National Results, 2012) In Sinaloa, the Program of School and Health makes an evaluation of indicators of the body mass. They do this evaluation to preschool, elementary and middle school students of the public and private educational area of Sinaloa. The results of these evaluations show us the next data for 2014:

Chart 1: Evaluation of Body Mass Index Elementary school students Sinaloa

EVALUATION	STUDENTS	PERCENTAGE
UNDER WEIGHT	81.234	14.74%
NORMAL	271.485	49.27%
OVER WEIGHT	109.305	19.84%
OBESITY	89.028	16.16%
TOTAL OF STUDENTS	598.594	100.00%
TOTAL EVALUATED	551.052	92.06%
TOTAL TO EVALUATE	47.542	7.94%
UNDER WEIGH+ OVER WEIGHT + OBESITY	279.567	50.73%

Source: SEPyC, the Program School and Health, 2014

Note: It's from all the students of the private and public sector of preschool, elementary and middle school

As it shows the above Chart almost 36% of the basic school population in Sinaloa has obesity or over weight. Almost 4 of 10 children are suffering the consequences of this disease. The incidence in childhood Diabetes or the predisposition to this disease deserves a special mention.

4. Consequences of Childhood overweight and Obesity

Health has an essential role in shaping people's skills, especially in developing physical abilities, reasoning, cognitive functioning and social interactions, particularly during childhood; health has a significant impact on the performance of each individual. Recently, it has been widely recognized that other possible causes of overweight and obesity are hormonal imbalances, such as hypothyroidism (under-active thyroid gland) or Cushing's syndrome, although key indicators of these problems are poor eating habits and lack of exercise. In addition, these conditions bring psychological and physical problems (Montoya, 2011). The consequence of obesity is the accumulation of fat in the body; its effects are alarming in adulthood, primarily for health related illnesses such as diabetes and cardiovascular problems. There is also the risk of developing psychological disorders during adolescence. Besides physical pathologies, children can develop psychological problems. Bullying or rejection by peers can lead to low self-esteem. These children are marginalized by their appearance, so much so that disorders such as bulimia, anorexia, depression are often developed, and thus lead to detrimental habits like drug and alcohol use. In addition, health has a significant impact on school performance. There is a correlation between obesity, self-esteem and achievement, i.e. obesity causes abnormal behavior (self-esteem) and abnormal cognitive application (school performance). Also, obese students are more likely to lose a school year and lag behind in advancing basic education compared to their peers. It states that "childhood obesity, especially in girls, influences obtaining lower grades compared to their thinner companions (...) The results showed that girls who were obese, as measured by BMI (body mass index) at age 11, had lower academic achievement compared to those with a healthy weight." (Merlo, 2014).

Besides these problems, obesity and overweight can be decisive factors to health problems in the development of childhood. Special attention has a possible incidence in the increase of Diabetes of this segment of the population. The presence of overweight and obesity in childhood persists into adolescence, and usually will creep into adulthood. Also, certain diseases, seasonal and related to the weather, occur most often in people with overweight and obesity.

5. Climate and Electrical Infrastructure in Sinaloa Public Schools

Climate is the state of atmospheric conditions influencing a particular area. The climate affects individuals with overweight and obesity. In the state of Sinaloa, the weather is warm (sub-humid in 48% of the state, 40% dry and semi-dry, 10% very dry and 2% sub-humid temperate). The annual temperature revolves around 25 °C, the minimum temperatures are about 10.5 °C in January and average maximum may be greater than 36 °C during the months of May to July. The Ensenada Center for Scientific Research and Higher Education has a climate database northwest of Mexico, where the atmospheric temperature reported in the state of Sinaloa has had only slight variations (Ensenada Center for Scientific Research and Higher Education, 2014). Furthermore, the Northwest Regional Research Center of the National Institute of Forestry, Agriculture and Livestock (INAIFF) also reported that temperatures in the municipalities of Sinaloa have not registered significant variations in the period between 1961-2003 (Ruiz, C., JA, et al., 2005). According to the National Institute for Statistics and Geography INEGI, 48% of the state of Sinaloa, located in a northeast-southeast strip ranging from Choix to the border with Nayarit, has a warm sub-humid climate, 40% is dry or semi-dry climate present in a belt stretching from El Fuerte to Mazatlan, 10% is very dry and is located in the area of Los Mochis, and the remaining 2% is humid temperate climate located in the upper parts of the Sierra Madre Occidental. The average annual temperature in the state is around 25 °C, the minimum average temperatures is about 10.5 °C in January and the average maximum may be greater than 36 °C during the months of May to July. Most rainfall occurs in the summer during the months of July to September; the average rainfall in the state is 790 mm per annum. (National Institute of Statistics and Geography, 2014).

6. Climate Projections and Electrical Infrastructure and Air Conditioner Needs.

In order to spread awareness about the weather in Mexico, the National Institute of Ecology and Climate Change (INECC / SEMARNAT) and the Center for Atmospheric Sciences of the National Autonomous University of Mexico (UNAM) conducted an investigation and presented data on variations and climate projections for each state in Mexico. In the case of Sinaloa, the weather is dry and semi-dry (with an annual average temperature between 24 and 25 °C and annual rainfall of 600 mm (National Institute of Ecology and Climate Change, 2014).

Chart 2: Temperature and precipitation trends of the state of Sinaloa

Year	Average annual temperature	Total annual precipitation
2020	Increases between 0,5°C y 1,0°C	Varies between +10% and -10%
2050	Increases between 1,5°C y 2,5°C	Varies between +10% and -20%
2080	Increases between 2°C y 4°C	Decreases between +5% and 30%

Source: INECC 2014

Sinaloa presents a temperature increase of between 0.5°C and 1.0 °C by 2020, and between 2 °C and 4 °C by 2080; 2050 has a projected variation in rainfall of + 10% to -20%, and a decrease between 5% and 30% for 2080. Currently, Sinaloa has a variable room temperature, in isothermal values. However, the average temperature in most of the territory is 24 °C. Coupled with this information is the report from the Northwest Regional Research Center INAIFF (Ruiz, C., JA, et al., 2005). These two sources, then, are the basis to verify that there has not been, nor will there be, large variations in ambient temperatures in Sinaloa to justify the need, firstly of air conditioners; secondly for power substations to operate these devices; and finally, a bigger budget for the acquisition of infrastructure to cover the quota for increased electrical consumption. Additionally, research on climate change confirms that during the twentieth century there was an increase of 0.7°C in the average temperature of the planet; however, if alleviating the effects of these changes with the installation of electrical substations in schools Sinaloa, we must also consider the environmental impact of their installation. This subject will be further studied in point 10 of this study.

7. Climate, overweight and obesity

It is remarkable how certain diseases are related to weather and seasons. There are diseases that are suffered in certain types of weather. In the state of Sinaloa, for example, diseases such as hyperthermia, also known as heat stroke or sunstroke is commonly recorded; this is a life threatening disease. Hyperthermia occurs when people are exposed to high temperatures, causing dysfunction in the thermoregulatory system, deleting the level of fluid and sodium from the body which can lead to death.

Hyperthermia is the state of abnormally high body temperature above 40 °C, without the intervention or participation of the hypothalamic thermoregulatory mechanisms. (Ministry of Health, 1999). The body of the overweight and obese has a greater problem in regulating body temperature; and due to the high temperatures recorded in most of the territory of the state of Sinaloa during the summer, the population in general must take preventive measures to avoid hyperthermia or heatstroke. In this sense, the segment of the population that registers a greater predisposition to suffer them, having less capacity of removing heat from the body, are the overweight and obese individuals, due to the fact that the mechanism of physiological regulation of body temperature is altered by increased body fat. In addition, the relative concentration of total body water is lower, since fat does not hold water. Days of intense heat in overweight or obese individuals demand measures to prevent heatstroke, because they are more prone to suffer it due to their low capacity to remove heat from the body. This is due to the fact that the mechanism of physiological temperature regulation is disturbed by the increase of body fat. Overweight produces an increase in body temperature, due to the concentration of dysfunction in the body is smaller relative to that of a non-overweight person. This is because fat does not hold water. These factors cause organ failure, which generates greater weakness and exacerbates an individual's predisposition to hyperthermia. This failure occurs because the body cannot regulate body temperature, which is 36 degrees, approximately, against very high external thermal conditions. Symptoms of heat stroke are manifested in acute headaches; temperature increase to 40 degrees; vomiting, retching or nausea; accelerated heartbeat, dehydration, and confusion when the process is well underway; and may even result in seizures and death (The Gazette, 2012).

8. Measures to prevent childhood overweight and obesity

Overweight and obesity generate an economic impact: in February 2010, the Ministry of Health published a document entitled "Technical Bases for the National Agreement on Health Food - Strategy Against Overweight and Obesity." In this document, an estimated direct cost is presented for the medical care of diseases attributable to overweight and obesity: "The estimated indirect cost to the national economy for lost productivity due to premature death in 2008 pesos (present value) attributable to overweight and obesity has increased from 9.146 million pesos in 2000 to 25,099,000 pesos in 2008 under a baseline scenario (ranging between 15,059,000 and 25,099,000 pesos, depending on the scenario). This implies an average annual growth rate of 13.51%. On the other hand, the direct cost estimated for medical care of prevalent cases of diseases attributable to overweight and obesity has increased in 2008 pesos (present value) of 26.283 million pesos in 2000 to 42,246,000 pesos in 2008 (under a baseline scenario, since the latter figure estimates range from 42.246 million pesos and 54,920 million pesos depending on the scenario). That is, this cost has increased by 61% during the period 2000-2008. The latest figure mentioned cost for 2008 (42.246 million pesos of 2008) represents 33.2% of federal government spending on health services on the individual budget in that fiscal year. By 2017 it is estimated that such spending will fluctuate between 77.909 million pesos in 2008 and 101 281 million pesos in 2008 (depending on the scenario), which represents between 60.5% and 79.5% of federal government spending on health care per person in the 2008 budget". (Ministry of Health, 2010: 29). The focus of this National Agreement focuses on prevention. Institutions and experts in childhood obesity and overweight suggest that in order to prevent this problem there need to be a joint effort between the community, the school and the authorities. Healthy eating habits and physical activity among children of 6-10 years in schools are invaluable tools to address these problems. The National Agreement suggests that parents, students, teachers, managers and schools take workshops and conduct practical training, awareness and promotion, in order to increase physical activity in children, make vegetables, fruits, other healthy foods and water readily available, and restrict foods and beverages whose sale is banned by school guidelines established by the Ministries of Health and Education.

The conclusions of the National Agreement include: The analysis of contextual determinants of overweight and obesity presented in this report supports the need for a policy focused on modifying the environment in order to produce a change in individual behavior through multisectional strategies and intersectional order government ... Furthermore, it is essential to increase the systems and sources of information in order to monitor key indicators and assess all policies and intervention programs, promote the development of research in public health programs for the prevention, and finally, work with regional and global partners to leverage the experiences and benefits of their policies and initiatives against the epidemic. (Ministry of Health, 2010: 73).

The study by the National Agreement outlines the consequences of overweight and obesity, and in addition, in the particular case raised in this study, there is another element that is directly affecting public finances, the cost of electricity infrastructure and air conditioners, as well as its operation.

9. School Programs for the Prevention and Control of Overweight and Obesity in Sinaloa: Expenses and Costs

Overweight and obesity in combination with the weather in states with as hot and dry climate as the state of Sinaloa are cause for new expenditures for grade-school campuses. In the 2013-2014 period, the primary educational system in Sinaloa had 2,896 schools (30 indigenous primary schools and 2,866 primary schools). In the search for solutions to the problems observed in the grade-schools in Sinaloa in relation to the prevention and control of obesity and overweight, it is important to consider that of the 2,896 campuses, 1,665 are multigrade schools, representing 58.1%; and of these, 93.7% are located in small, scattered and inaccessible rural areas. (Sinaloa State Government, 2011, p. 29). In 2014 the Secretary of Education in the state of Sinaloa, Francisco Frias Castro, claimed that each school has to install an electrical substation costing between 180 and 400 thousand pesos, larger schools require more expensive equipment which must be added to the cost of air conditioners and installation; some schools require between 6 and 9 and up to 15 air conditioners (Agency Reform, 2014). Frias Castro said: "The problem is only 25% covered; this was also thanks to the support of parents, who we collaborate with paying bills through funds for School consumption." (Zazueta, 2014). To achieve the commitment that all primary schools have air conditioning requires a significant increase in the budget of the Public School System, or SEPyC. This effect should be added to the number of schools that do not yet have air conditioners, schools that have air conditioners but not in every classroom, and finally, libraries, workshops, multipurpose classrooms, etc. Similarly, the total acquisition cost for air conditioners must be added (they have an average of 10 years of life), installation and annual maintenance service for equipment and the increase in electricity spending. For this there must be 2015 air conditioners and substations acquired, approximately each school that has a classroom for 6 grades of primary and address 7 devices and a substation are required. This would reflect the following costs (Tables 1, 2, 3, 4, 5, 6, 7, 8 and 9).

Table 1: Total expenditure for purchase of air conditioners for elementary schools in the state of Sinaloa (2015)

School total	25% de of schools with existing AC units	Schools with no AC	Minimum requirements for AC: 6 classrooms and Main office	Total of needed AC units	Average cost for 3 ton AC unit (pesos)	Total expenditure (pesos)
2,896	724	2,172	7	15,204	26,000	395,304,000

Source: Researcher.

Note: 25% Schools with existing AC units figure from Sinaloa State Secretary of Education; Francisco Frías Castro.

Table 2: AC unit needed installation costs for 2015

Total AC units needed	Average cost for AC unit installation (pesos)	Total expenditures (pesos)
15,204	750	11,403,000

Source: Researcher

Notes: The data of all air conditioners needed was obtained in Table 3. The average cost data was obtained to request a quote several businesses that offer this service.

Table 3: Yearly expenditures for AC Unit maintenance in 2015

School total	Minimum requirements for AC: 6 classrooms and Main office	Total of needed AC units	Average cost for AC unit installation (pesos)	Total expenditure (pesos)
2,896	7	20,272	300	6,081,600

Source: Researcher.

Note: Average installation cost derived from quotes from several specialized local businesses.

Table 4: Total expenditures for AC unit acquisition, installation and maintenance for primary schools in the State of Sinaloa in 2015

Total cost for AC unit acquisition for primary schools in the State of Sinaloa in 2015(pesos)	Total cost for AC unit installation (pesos)	Total cost for AC unit maintenance (pesos)	Total expenditures (pesos)
395,304,000	11,403,000	6,081,600	412,788,600

Source: Researcher. Summary of tables 3,4 y 5.

The SEPyc goal for every AC unit in every primary school also involves the acquisition of substations as expressed on June 12, 2015 the governor of Sinaloa, Mario López Valdez. He reported that there are over 500 schools that require electrical substations; despite this "there are only 75 million pesos allocated by the state government and the other 75 million who managed to CFE, which will only cover the installation of between 200 and 300 power substations." On the other hand, he said, the State Congress has joined the efforts being made by various institutions to get special rates (El Debate, 2015). The following table outlines the total expenditure that would be required for the year in question:

Table 5: Electrical substations required by Sinaloa State primary schools

Substantivos needed	Average substation and installation cost (pesos)	Total expenditures (pesos)
2,171	500,000	1,085,500,000

Source: Researcher.

Notes: Total of electrical substations needed taken from schools in need of air conditioning units.

Total cost of electrical substations and their installation taken from information by the Governor of Sinaloa State. With regard to energy consumption rates, on June 30, 2014, before the State Congress Representative Martin Perez presented a "Point of Agreement" in order to obtain a special electricity tariff for educational institutions in the state, arguing: "Most schools fall under the "2" rate, which is the commercial rate. I should mention that this is the most expensive rate; on average, a primary school with 6 classrooms and an office with 3 ton "mini-split" AC units on would pay at least 13,000 pesos per month, and only if it is used on one shift; 25,000 pesos a month would be the figure for a two-shift school" (Sinaloa online, 2014). Based on the above information we found electricity expenditures in primary schools with one shift, in order to have air conditioning, would be as shown in the following table:

Table 6: Annual expenditures for electricity consumption in Primary Education schools in Sinaloa State for 2015, per shift

Total schools with 1 shift	Average Energy consumption per shift	Monthly cost (pesos)	Months in operation	Total annual expenditures (pesos)
2,841	13,000	36933,000	10	369,330,000

Fuente: Researcher.

Note: Monthly costs of electricity per school per shift taken from State Congressman Martín Pérez arguments during debate for lowering schools' electricity rates in the State Congress. As far as two-shift schools, according to SEPyc in 2011 there were 55, which would indicate that are a total, as show in the following table:

Table 7: Full-time (two-shift) Schools in Sinaloa 2015

Schools in Program Full-Time Sinaloa	
Level	Number of Schools
Federalized Pre-school	42
State Pre-school	4
State Elementary	8
Federalized Elementary	46
PRONIM	10
TOTAL	110

Source: Researcher, with data from the SEPyc of Sinaloa

If they have air conditioning, the annual expenses of electric energy would be as it shows in the next Table:

Table 8: Full-time (two-shift) primary school annual expenditures, for electricity consumption due to air conditioning in Sinaloa for 2015

Total of two-shift schools	Average monthly electricity bill (pesos)	Monthly cost (pesos)	Months in operation	Total annual expenditures (pesos)
55	26,000	1,430,000	10	14,300,000

Source: Researcher.

Note: Monthly costs of electricity per school per shift: Taken from State Congressman Martín Pérez arguments, during debate for lowering schools' electricity rates in the State Congress. Total annual expenditures for all Sinaloa Primary schools, if they held 6 classrooms and a main office, if they had AC units is shown in the following table:

Table 9: Total annual expenditures, for electricity consumption due to AC units, in Sinaloa primary schools for 2015

Total annual expenditures For Single-Shift Primary Schools (pesos)	Total annual expenditures For Double-Shift (Full-Time) Primary Schools (pesos)	Total annual expenditures due to electricity (pesos)
369,330,000	14,300,000	383,630,000

Source: Researcher.

In addition to the efforts to provide air conditioning to primary schools in order to serve children with overweight and obesity, there are other health-related programs in Sinaloa. The School Health program, which dates back to 1986, and which is promoted as a global initiative by the Pan American Health Organization (PAHO), along with other international organizations such as the World Health Organization (WHO), United Nations Fund Children's Fund (UNICEF) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), seeks to develop a comprehensive approach to health-related education in school. Currently, the program aims to improve the health of schoolchildren through intersectoral coordination, with the participation of public, private and social agencies. It aims for the education community to devise strategies for promoting better health at schools. This program seeks to influence the main causes for overweight and obesity in schools, both individually and collectively, as well as to promote a healthy physical and psychosocial environment.

The objectives have evolved according to the epidemiological situation of the school, directing their attention to special education and the physical infrastructure of schools. There is also the Worthy School Program (Programa Escuelas Dignas), of the National Institute of Physical Education Infrastructure (INIFED), which attends to the requirements of educational infrastructure at basic levels. This program requires that committees be formed in order to make formal requests for financial resources (subsidies) to improve the conditions of their campuses. In 2014 135 schools of basic education of Sinaloa were registered in the program. Another program is School and Health (Escuela y Salud), from the Directorate General of Health Promotion of the Ministry of Health. In this initiative, health is considered as a support in order to have good physical and mental performance. The objective of this program is to make timely interventions to basic education students, as well as those in secondary and higher education, in order to develop skills that may enable them to exert greater control over the determinants of their health, as well as to improve it, and thus increase student achievement. This program has been set seven specific objectives, and the very first objective is aimed at preventing overweight and obesity (General Directorate of Health Promotion, 2013). There is also the "Turn Yourself On, Live Better" program (Actívate, Vive Mejor) launched in 2008, which is focused on the physical activity of students as part of their school day, this way fulfilling the commitment of the National Agreement on Food Safety. Another effort is the National Development Program 2007-2012 includes promoting physical activity and sports in schools throughout the national education system. In the R.12^a.5 agreement, the National Council of Education Authorities (CONAEDU) requires that state education authorities encourage the implementation of the National Program for Physical Activation, as well its routines, as part of the school day, with the ideal of 30 minutes of daily physical activity (in two sessions of fifteen minutes) in the elementary schools of the country. (National Physical Activation Program School, 2002). As shown, several programs have been instituted that are focused on finding solutions and actions to combat overweight and obesity.

There is recognition of the need to intervene and try to solve this and other health problems, which stems from the intake of energy-dense foods that are high in fat, salt and sugar, as well a sedentary lifestyle.

10. Environment and Budget

The 2011-2016 State Development Plan in Sinaloa includes the Sectorial Program, which aims at implementing educational policies for improving overall quality of health by: expanding coverage and equity, professional teacher development, improvement of infrastructure and educational equipment, research promotion, technological and educational innovation, and strengthening the culture of assessment and accountability. This intends to comply with Article 13 of the Planning Act of the State of Sinaloa, which compels the offices of the State's public administration to develop the 2011-2016 Education Sector Program, specifically in regards to the Infrastructure and equipment section, where the demand that equipment and infrastructure should be sufficient and of excellent quality is outlined. Schools should provide the necessary operating conditions and safety; and in this context it is stated that it is important to consider the climate, as global warming and earthquakes, both increasing in intensity in Sinaloa, are accelerating the deterioration of physical infrastructure (Government of the State of Sinaloa, 2011).

Based on this context (global warming), as set forth in Education Sector Program for 2011-2016, school principals are required to procure adequate equipment and furnishings, such as AC units and electrical substations. Today, more than 4,500 air conditioners have been distributed to schools Sinaloa, but only about 1,000 are used due to the lack of extra wiring and the lack of electrical substations that allow consumption; this situation was tragically unforeseen. On the other hand, 150 substations were installed in 2013, and a similar amount is planned for 2014; all of this on the grounds of climate change. Finally, the following demand has been proposed to the Chamber of Deputies of the Mexican Congress by the Federal Representative for Sinaloa, Francisca Elena Corrales: "the head of the Ministry of Education (SEP) is encouraged to enact, via the National Institute of Physical Infrastructure Education and in coordination with the government of Sinaloa, the necessary adjustments in schools due to the prevailing high temperatures." (Parliamentary Gazette, the Chamber of Deputies of the Mexican Congress, 2014).

From the data summarized here, changes in climate, changes in atmospheric temperature and levels of overweight and obesity, can all be seen as elements to test the hypothesis that it is imperative to differentiate the need for electrical substations and air conditioners not due to climatic variations, but due to the increase in the school population with overweight and obesity, including, perhaps, those of the teachers and staff. On the other hand, we must begin the discussion on climate change and the effects that the massive installation and operation of electrical substations and air conditioning equipment can have in this phenomenon. Mario Molina Center AC, a research center on the environment, energy use and climate protection, states that: "The average global temperature increased on average 0.7 °C during the twentieth century, why does such a small rise in temperature causes so much concern? And what is the relationship between temperature changes that are occurring in the earth's climate? The climate is a complex system in which many factors interact, including solar radiation, the parameters of the Earth and its orbit (the distance from the sun and tilt angle), the composition of the atmosphere, the water cycle affecting the characteristics of the land surface and biosphere. (Centro Mario Molina, A.C., 2004). If the alteration of some of these factors contributes to the rest, it is evident that the installation of 300 or more electrical substations in the state of Sinaloa can have a high environmental impact, associated mainly with the filtration of oil with Askarel (biphenyl polychlorinated, polychlorinated Diphenyl or polychlorinated biphenyls) which, "according to the US Agency for Industrial Hygienists, one milligram of askarel in the atmosphere per cubic meter (1mg / m³) is sufficient to cause cancer." (Alvarado Menchaca, & Rojas, 2009). That is, the installation of even more electrical substations and air conditioners in educational establishments in response to overweight and obesity of schoolchildren and predictably educators, in addition to the problems involving budgets, would represent an additional element to add to the causes that are the basis of the phenomenon of climate change. Finally, concerning composition of the budget for government, 2015 had a budget of 9,300 million pesos for the Educational Sector in Sinaloa, according to the numbers of SEPyc of Sinaloa. From that budget 8,973 millions were designated to personal, paying the teachers and the administrative employees. This represents 96% of the educational sector budget, leaving only 4% for operating schools and services (We will call it: Operational budget OB), which represented approximately 327 million pesos. A comparative analysis of the different data in the reported Tables shows how this OB (total less payment of personal services) is widely insufficient considering only the elementary schools of Sinaloa.

The analysis of these Tables shows the next analysis: Taking as reference the OB of the educational sector of Sinaloa in 2015, it will require: For acquisition, installation and maintenance of air conditioning on elementary schools, 412.8 million pesos (Table 4), the 126% of OB, for the installation of substations in elementary schools, 1,085.5 million pesos (Table 5) 332% of the OB and, for the payment of the annual consumption of electric energy in elementary schools, 383.6 million pesos (Table 9) 117% of the OB. Only the sum of these three components represents 575% of the OB from the Budget to the Educational Sector in Sinaloa in 2015.

11. Conclusion

Overweight and obesity are public health problems worldwide, and in Mexico specifically, the cost of these conditions has been estimated, in 2008 pesos, for the year 2000 at 26 billion pesos, for 2008 at 55 billion, and for in 2017 more than 100 billion (Ministry of Health, 2010). In Sinaloa, as describe in Chart 1 above, is present in 36% of the basic education students of the entire State. These conditions have begun affecting childhood, and their prevalence is a current and worrying issue due to their alarming rate of increase. Children are more likely to develop diseases at younger ages, such as diabetes and cardiovascular disease. This problem has disrupted environments in schools, a situation reflected in low academic achievement and increased dropout rates. There are added needs for school campuses: teachers trained to serve this population, the adaptation of school facilities, and the need of equipment and furniture for creating a friendly atmosphere in order to guarantee the physical and mental health of both staff and school children. In the state of Sinaloa, electric power substations for air conditioners have been installed because of the effect of climate on students, especially those with overweight and obesity. This segment of the school population is more prone to hyperthermia. Finally, these sets of requirements have significantly increased the education budget. The demand has already reached the Chamber of Deputies of the Mexican Congress, demanding further studies such as this paper, in order to adopt the budgetary impacts to governmental organizations in Sinaloa. As demonstrated above the great amount of budget resources that would mean not only the installation of the necessary infrastructure for the operation of air conditioning, but also the same operations (575% of the OB of the educational sector in Sinaloa for 2015). It'll make practically impossible the public education in Sinaloa as a constitutional duty of the Government. The statistics generated by different institutions focused on the prevention and control of overweight and obesity in the elementary school population indicate that these health problems affect not only the individual who suffers them, but the family and society to which he or her belongs to. The disorders have various aspects: social, economic and psychological.

It is a mistake to raise the need for air conditioning on the grounds of high atmospheric temperatures, due to the fact that overweight and obese individuals are the primary source of the problem. This is a multifactorial health problem, and, if not addressed, Mexico will become a country with increased individuals with special needs, which will affect development at all levels. It has been proved that overweight or obese individuals in elementary schools in the state of Sinaloa generate increased public spending in the education sector. For maintenance a special environment, as well, as to have a staff prepared for their attention and the implementation of specific programs for these children. We find in the basic climatologically statistics of the State of Sinaloa (period 1961-2000), of the Regional Research Center Northwest (INAIFF), that atmospheric temperatures recorded in recent years in Sinaloa have not undergone major changes. This shows that the basis to explain the need for air conditioners in Sinaloa schools is not due to a climatic factor, but due to the existence and growth of children who are overweight or obese. It is imperative to distinguish that this need is not due to weather variations, but to the increase in overweight and obese people not only in the student population, but also perhaps in that of teachers and administrators. Finally, there are the implications that may arise due the operation of electrical substations and air conditioners in regards to climate change.

Sponsoring Information:

This paper is the product of the work of investigation developed in the sabbatical year 2014-2015 as a Professor and researcher at the Faculty of Social Sciences in Mazatlan of the Universidad Autonoma de Sinaloa. It's related with the work of the Academic Group "Society and Culture", in the Line of Generation and Application of Knowledge (LGAC for its Spanish acronym), "Society, Political Culture and Representation".

References

- Agencia Reforma. (9th of July, 2014). *News Network Communication*. Taken the 14th of June, 2015, from www.nnc.mx: <http://www.nnc.mx/movil/articulos/?idarticulo=1404914213>
- Alvarado, R., Menchaca, O., & Rojas, D. (2009). *Manual de mantenimiento de subestaciones de distribución del campus universitario, UNAM*. México: UNAM.
- Animal Politico. (s.f.). Taken the 10th of April, 2015, from <http://www.animalpolitico.com/2015/02/sep-invierte-3-mil-091-millones-en-programas-que-poco-contribuyen-mejorar-la-educacion/>
- Chamber of Deputies of the Mexican Congress, LXII Legislature. (3 Diciembre, 2014). *Proyecto Presupuestal de Egresos de la Federación para el Ejercicio Fiscal 2015*. Recuperado el 25 de Febrero de 2015, de Exposición de Motivos: Previsiones de Gasto Programable para 2015: http://www.diputados.gob.mx/PEF2015/exposicion/3previsiones_gasto.pdf
- Chamber of Deputies of the Mexican Congress, LXII Legislature. (9 de Octubre de 2014). <http://gaceta.diputados.gob.mx/>. Taken the 7th of January, 2015, from <http://gaceta.diputados.gob.mx/Gaceta/62/2014/oct/20141009-VI.html>
- Centro de Investigación Científica y de Educación Superior de Ensenada. (12th of November, 2014). <http://peac-bc.cicese.mx>. Taken from <http://peac-bc.cicese.mx/datosclim/index.html>: <http://peac-bc.cicese.mx/datosclim/graficabc.php?seccion=climatologia19712000&idestacion=25015&tablaestado=SIN>
- Centro de Investigación Científica y de Educación Superior de Ensenada. (12th of November, 2010). *Observaciones*. Taken the 18th of January, 2015, from the State Summary: <http://peac-bc.cicese.mx/datosclim/dcbc.php>
- Centro Mario Molina, A.C. (2004). *Centro Mario Molina*. Taken the 3rd of September, 2015, from <http://centromariomolina.org/el-cambio-climatico-y-el-aumento-en-el-nivel-del-mar/>
- Dirección General de Promoción de la Salud. (6th of May 2013). *Programas de Acción de la DGPS*. Taken the 1st of April, 2015, from *Escuela y Salud*: http://www.promocion.salud.gob.mx/dgps/interior1/programas/escuela_salud.html
- El Debate. (12th of June, 2015). *El Debate*. Taken 14th of June, 2015, from www.debate.com.mx: <http://www.debate.com.mx/losmochis/Inaugura-Malova-obras-en-el-9-de-Diciembre-20150612-0108.html>
- Gaceta Parlamentaria de la Cámara de Diputados. (9th of October 2014). *Gaceta Parlamentaria, año XVII, número 4129-VI*. Taken the 7th of January 2015, from *Proposals*: <http://gaceta.diputados.gob.mx/Gaceta/62/2014/oct/20141009-VI.html>
- Government of the State of Sinaloa. (4th of May, 2011). *Programa Sectorial 2011-2016*. Taken the 21st of April 2015, from *Education*: <http://www.sepyc.gob.mx/documentacion/Sectorial%20Educaci%C3%B3n%2015%20dic%20.pdf>
- Gutiérrez JP, R.-D. J.-L.-H.-N. (2012). *Encuesta Nacional de Salud y Nutrición 2012. Resultado Nacionales*. México: Instituto Nacional de Salud Pública.
- Instituto Nacional de Ecología y Cambio Climático. (15th of February). *El Cambio Climático en México*. Taken March 20th 2015 from *Information by State*: http://www2.inecc.gob.mx/climatico/edo_sector/estados/sinaloa.html
- Instituto Nacional de Estadística y Geografía. (15th of December, 2014). *Cuéntame*. Taken March 15th 2015 from *Information by State*: <http://www.cuentame.inegi.org.mx/monografias/informacion/sin/territorio/clima.aspx?tema=me&e=25>
- Instituto Nacional de Salud Pública. (1st of October 2012). *Encuesta Nacional de Salud y Nutrición 2012*. Taken the 7th of January 2015, from *Executive Summary*: <http://ensanut.insp.mx/doctos/ENSANUT2012SintEjec-24oct.pdf>
- Instituto Nacional de Salud Pública. (8th of May, 2014). *Instituto Nacional de Salud Pública*. Taken the 2nd of April 2015, from http://www.epidemiologia.salud.gob.mx/doctos/eventos_2013/Simposio_ANM_14_AGO13/3_Simposio_ANM_Obesidad_INSP_SBC.pdf
- Medlineplus. (s.f.). *Obesidad en niños*. Taken the 16th of March 2015, from *Posibles complicaciones*: <http://www.nlm.nih.gov/medlineplus/spanish/ency/article/007508.htm>
- Merlo, V. (11th of March, 2014). *Obesidad repercute en el desempeño escolar*. Taken 18 June 18, 2017: <https://holadoctor.com/es/noticias/obesidad-repercute-en-el-desempe%C3%B1o-escolar>

- Montoya, S. (5th of April, 2011). <http://www.saludymedicinas.com.mx/>. Taken from Salud y Medicina.com: <http://www.saludymedicinas.com.mx/centros-de-salud/obesidad/articulos/problemas-psicologicos-por-obesidad.html>
- Observatorio del derecho a la alimentación en América Latina y el Caribe. (2012). *Programas y Políticas Públicas*. Taken 12th of April, 2015, from Síntesis Ejecutiva del libro: *Obesidad en México: recomendaciones para una política de Estado*: <http://www.oda-alc.org/documentos/1365120227.pdf>
- Onmeda.es. (19th of March, 2012). *Obesidad: síntomas*. Taken 6th of April, 2015, from Enfermedades y Síntomas: <http://www.onmeda.es/enfermedades/obesidad-sintomas-4187-5.html>
- Organización Mundial de la Salud. (1st January, 2014). *ESTADÍSTICAS SANITARIAS MUNDIALES 2014*. Taken the 24th of January 2015, from Nuestros hijos son cada mas gordos: http://apps.who.int/iris/bitstream/10.665/112817/1/WHO_HIS_HSI_14.1_spa.pdf
- Organización Mundial de la Salud. (1st January, 2015). *Obesidad y sobrepeso*. Taken the 7th of January 2015, from Datos y cifras: <http://www.who.int/mediacentre/factsheets/fs311/es/>
- Programa Nacional de Activación Física Escolar. (1st January, 2002). *Comisión Nacional de Cultura Física y Deporte*. Taken the 28th of March 2015, from Activación Física Escolar: <http://activate.gob.mx/Documentos/Manual%20Activacion%20Fisica%20Escolar.pdf>
- RIODOCE. (9th of September 2014). (Riodoce, Productor, & RIODOCE) Taken the 4th of January 2015, from <http://riodoce.mx/suplementos/gula/rese-contra-la-obesidad-infantil-en-sinaloa>
- Rivera Dommarco, J. (2012). *Obesidad en México, recomendaciones para una política de Estado*. México: Dirección General de Publicaciones y Fomento Editorial UNAM.
- Ruiz C., J.A., G. Medina G., J. Macías C., M. M. Silva S., y G. Díaz P. (2005). *Estadísticas climatológicas básicas de Sinaloa (Período 1961-2003)*. Libro Técnico Núm. 2. INIFAP-CIRNO. Cd. Obregón, Sonora, México. 154 p.
- Secretaría de Salud. (22nd of Septiembre, 1999). *Norma Oficial Mexicana NOM-031-SSA2-1999*. Taken the 5th of January 2015, from Atención a la salud del niño: <http://www.salud.gob.mx/unidades/cdi/nom/031ssa29.html>
- Secretaría de Salud. (2010). *Bases técnicas del Acuerdo Nacional para la Salud Alimentaria. Estrategia contra el sobrepeso y la obesidad*. México: Subdirección de Comunicación Científica y Publicaciones del Instituto Nacional de Salud Pública.
- Sinaloa en línea. (7th of August, 2014). *Sinaloa en línea*. Taken the 20th of June 2015, from www.sinaloaenlinea.com:3%ADa-el%3%A9ctrica-las-instituciones-educativas-de-nivel
- Zazueta, M. (27 de Mayo de 2014). *El Debate*. Taken the 5th of June 2015, from <http://www.debate.com.mx/:http://www.debate.com.mx/culiacan/Hay-4-mil-500-escuelas-sin-aire-acondicionado-segun-censo-20140527-0082.html>